



Egyptian Atomic Energy Authority

National Center for Nuclear Safety and Radiation Control  
(NCNSRC-1983)

Central Laboratory for Environment Radioactivity Measurements Inter-  
comparison and Training (CLERMIT)



# Objectives of CLERMIT

The main objectives of the CLERMIT are:

- To establish the Egyptian radiological background map by the determination of natural and man-made radioactivity concentrations in soil, plant and water samples.
- To determine the radiological impact due to use of natural material contain high activity concentration levels of natural radioactivity in industrial field (NORM).

*CLERMIT*

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graph TD; CLERMIT([CLERMIT]) --> LaserFluorimeter([Laser fluorimeter]); CLERMIT --> GammaSpectrometer([Gamma spectrometer]); CLERMIT --> AlphaSpectrometer([Alpha spectrometer]); CLERMIT --> LiquidScintillationCounter([Liquid Scintillation counter]);
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*Gamma  
spectrometer*

*Alpha  
spectrometer*

*Laser  
fluorimeter*

*Liquid  
Scintillation  
counter*

## Water hyacinth (*Eichhornia crassipes*)



- Water hyacinth ( *Eichhornia crassipes* ) is an important aquatic weed plant of sub-tropical regions of the world some of the properties of this plant namely. Very high productivity rate ( doubling in a bout 6 days ) high plant density ( 10-50 kg wet wt. m<sup>2</sup> ) high growth rate ( 5 to 30 dry wt m<sup>2</sup> d<sup>-1</sup> ) and vertical as well as horizontal growth pattern in any aquatic condition.
- Dense population of this plant can render water ways unnavigable, reduce water flow and restrict commercial fishing.
- Continued massive herbicides and chemical use have added another level of pollution with little net benefit.
- A large amount of funding (especially from the World Bank) has so far not been able to stem this widespread Hyacinth invasion.

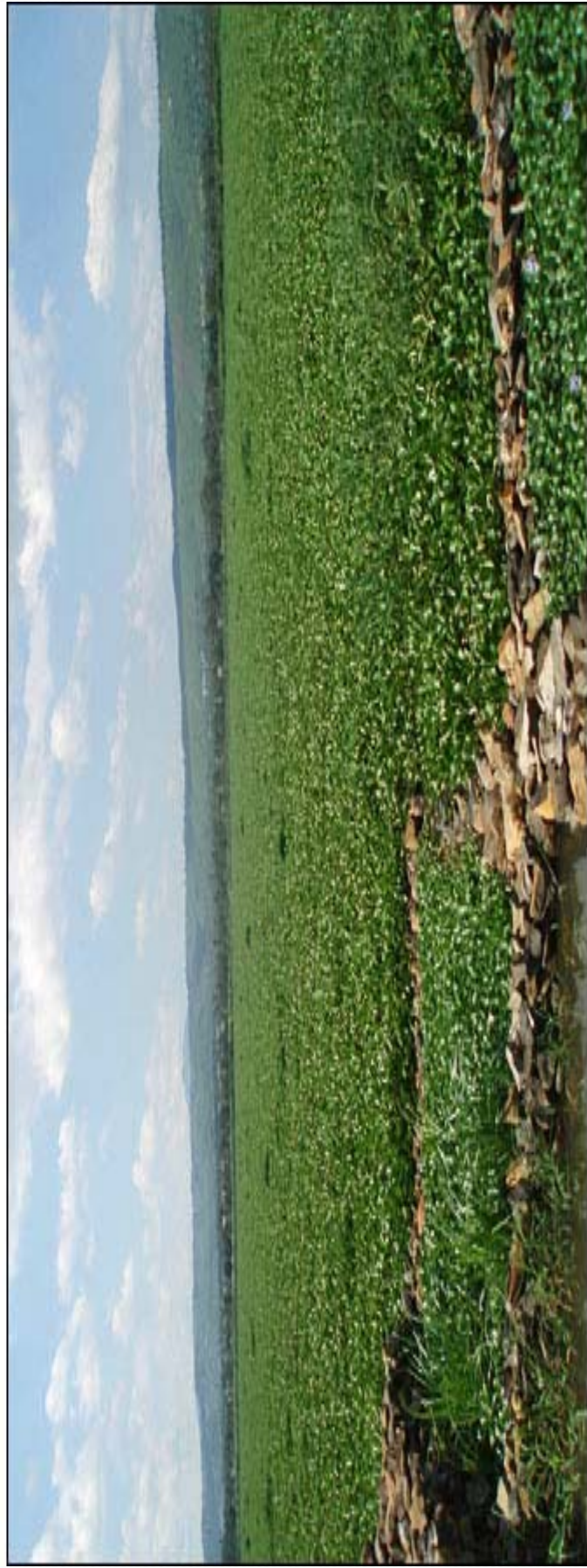




December 18, 2006



December 17, 2005



December 17, 2006









## Water hyacinth (*Eichhornia crassipes*)

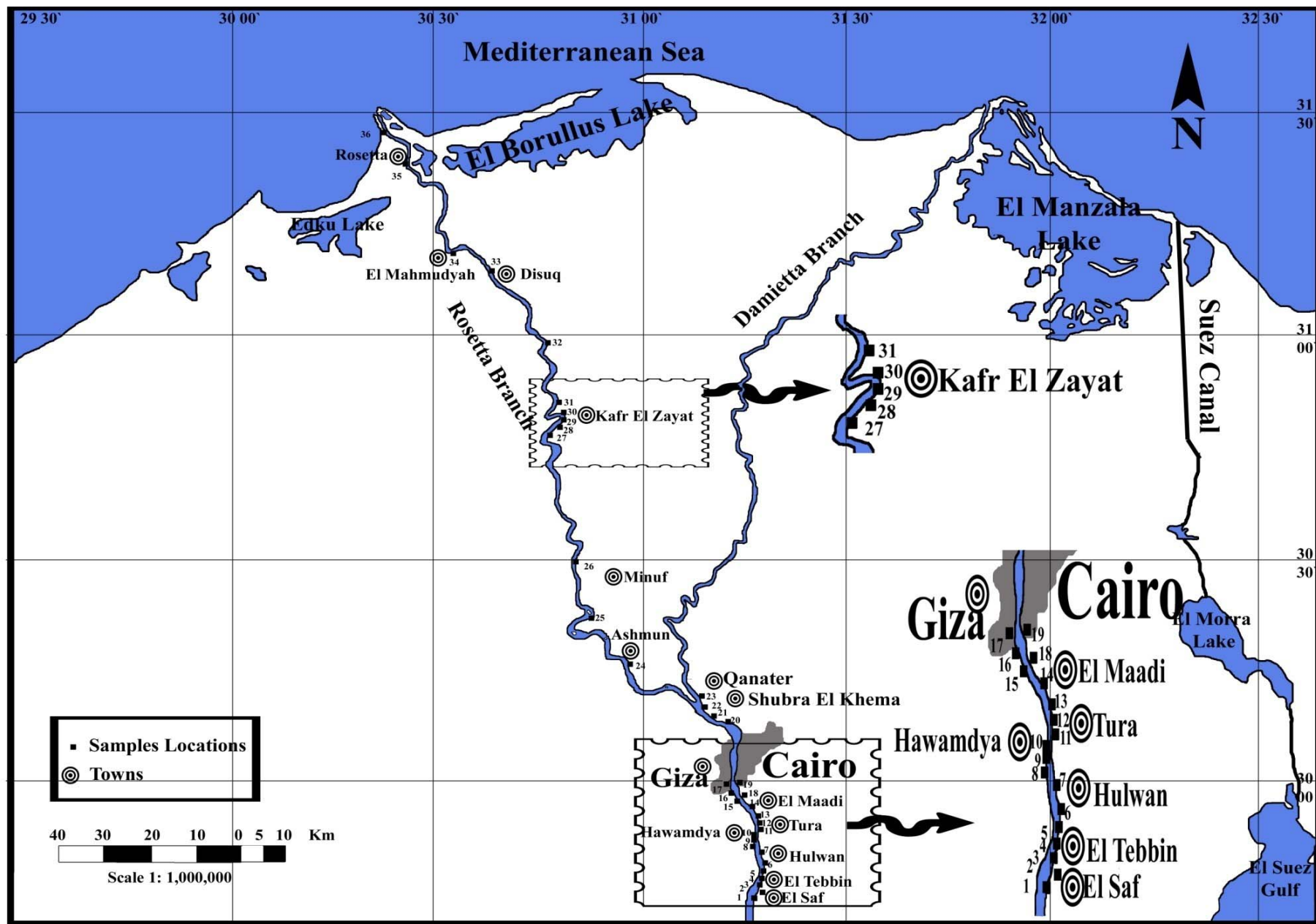
- Water Hyacinth Absorb as Accumulator for Toxic Elements (Cd, Cu, Hg, Pb).
- **But available Data about bioaccumulation of Uranium, Ra 226, Ra 228 by water Hyacinth.**
- It is used in domestic sewage treatments because of its properties as being a vascular aquatic plant, ability to translocates O<sub>2</sub> from the upper leaf areas into the roots producing an aerobic zone around the roots which is desirable in domestic sewage treatments, micro-organisms use metabolites released through plant root as a food source also products of the microbial degradation of the organics are absorbed and utilized as a food source by the plant along with N, P, K and other minerals.
- Anaerobic digestion: is a disposal method for the excess grown water hyacinth.
- Water hyacinth used as a feed and fertilizer.
- Ashing the plant biomass and recovering trace elements of interest.



## INVESTIGATION OF WATER HYACINTH IN BIOMONITORING PROGRAMME FRESH WATER ECOSYSTEM

Using :

- Instrumental neutron activation analysis.
- Gamma Spectrometer.
- Laser fluorimeter.
- ICP- AES.



Locations sites for the studied area

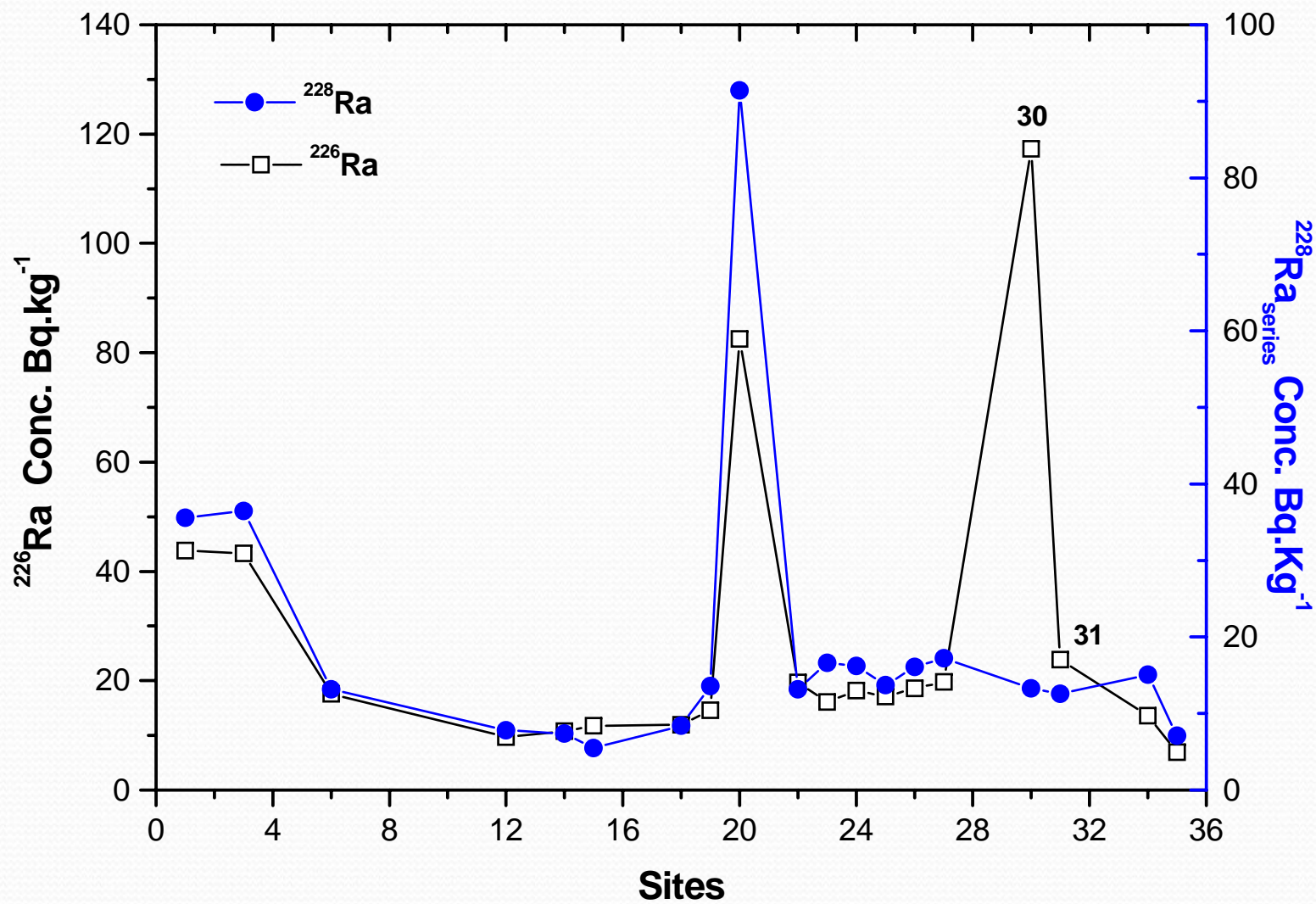


## **Site number of industrial facilities.**

<b>Site</b>	<b>Industrial facilities</b>
2	Coke factory for Coal and basic Chemicals + Iron and steel factory
4	National company for Cement production
7	Electrical power station
9	Hawamdyea factories for Sugar refining
12	Cement Tura for Cement Production
29	Soda company at Kafer El Zayat
31	Financial company for Phosphate Fertilizers



## The distribution of $^{226}\text{Ra}$ and $^{228}\text{Ra}$ activities in shore sediment samples by HpGe detector

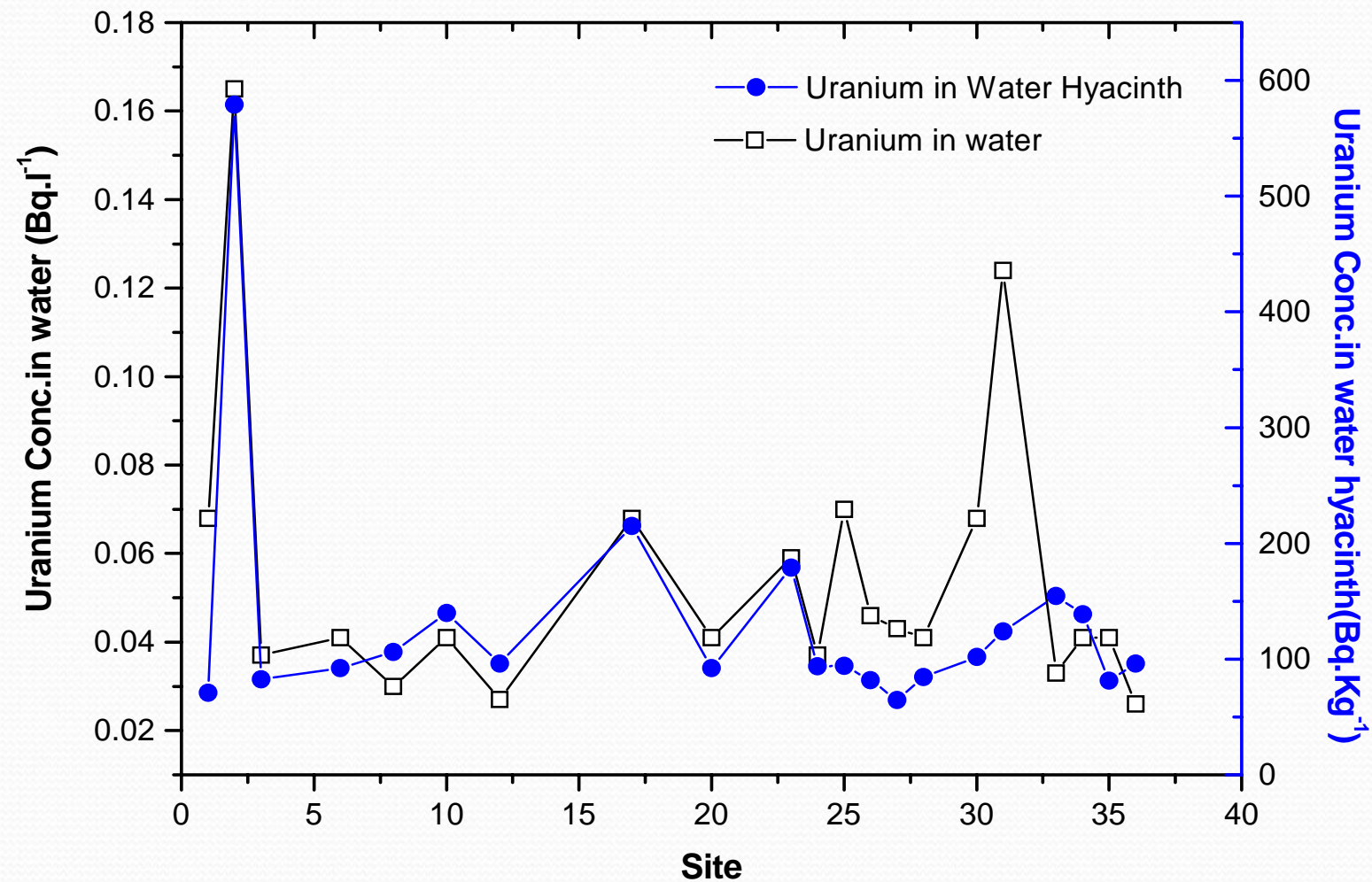


## The distribution of total uranium in water and water Hyacinth samples by Laser

Site	Water Bq l <sup>-1</sup>	Water Hyacinth Bq Kg <sup>-1</sup> d. wt.	B.A.F ( L kg <sup>-1</sup> )
1	0.068	71	1043
2	0.165	579	3507
3	0.037	82.5	2230
6	0.041	92.3	2251
8	0.03	106	3533
10	0.041	140	3415
12	0.027	96	3554
17	0.068	215	3162
20	0.041	92.3	2251
23	0.059	179	3034
24	0.037	93.9	3537
25	0.070	94.3	1347
26	0.046	81.6	1774
28	0.041	84.4	2059
30	0.068	102	1500
31*	0.124	124	1833
33	0.033	154.7	4687
34	0.041	138.6	3390
35	0.041	81.5	1989
36	0.026	96	3692

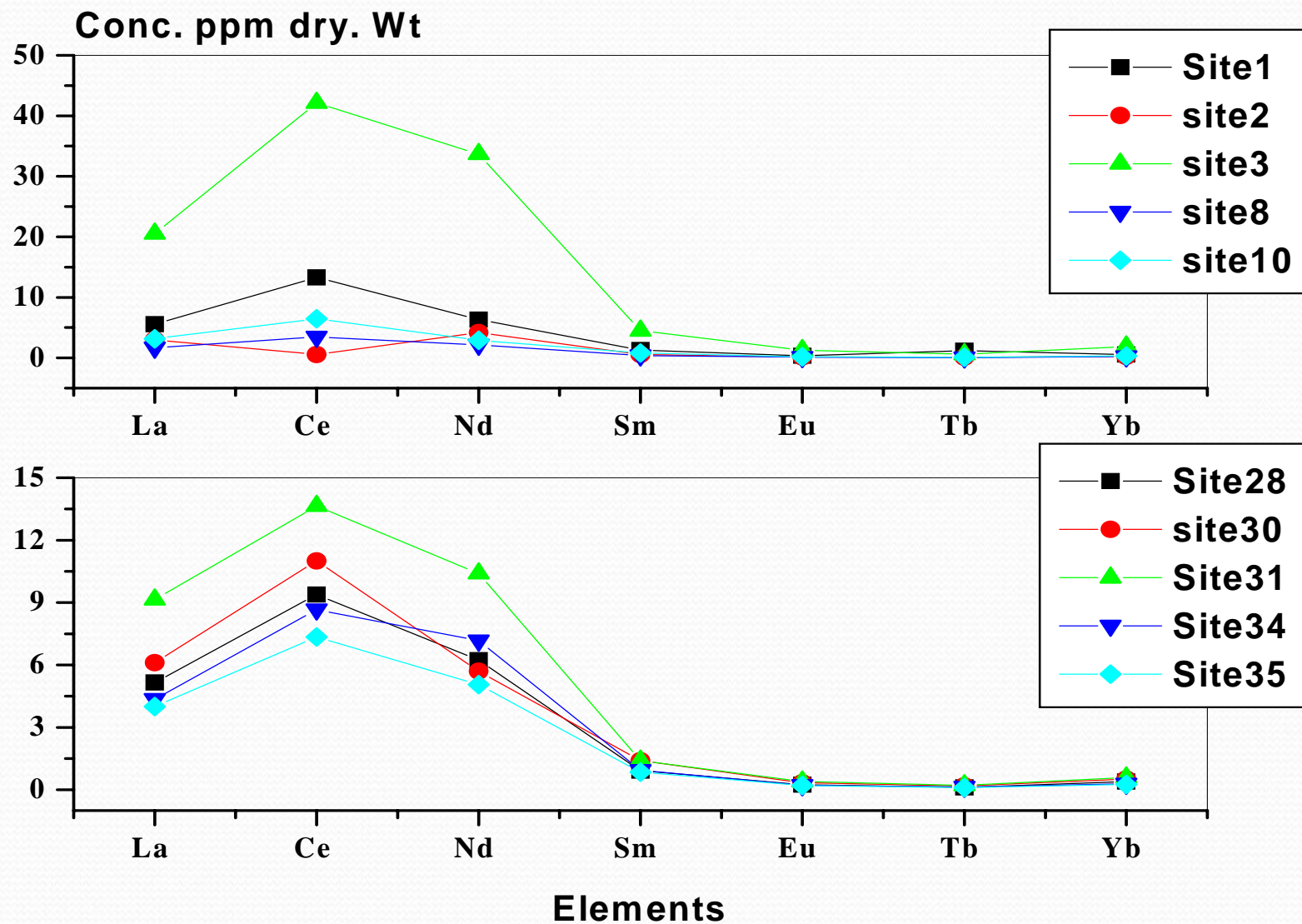


## The distribution of total uranium in water and water Hyacinth samples by Laser





## Instrumental neutron activation analysis of water Hyacinth samples



REEs Distribution in the Studied Sites

## Bio accumulation factor (ml. g<sup>-1</sup>) of Cr, Fe, Co, and Zn in water hyacinth

Site	Cr	Fe	Co	Zn
1	655	31208	471	184
2	489	28901	595	4768
3	1609	35281	1230	2542
8	320	4437	69	510
10	748	9371.8	99	700
28	350	31739	540	5432
30	966	184242	6240	4255
31	1670	992727	33100	8375
34	479	10282	111	1107
35	1140	21924	193	246



At site 31(after the fertilizer factory) Ca shows the lowest concentration. This decline in Ca content could be attributed to the fact that, the Soda company uses the river water in cooling ( $31000 \text{ m}^3.\text{day}^{-1}$ ) leading to an increase in water temperature, which may cause a thermal pollution in the area. Elevated temperature, increase the loss of  $\text{CO}_2$  from the water and decreases the solubility of  $\text{CaCO}_3$  according to the following equation:



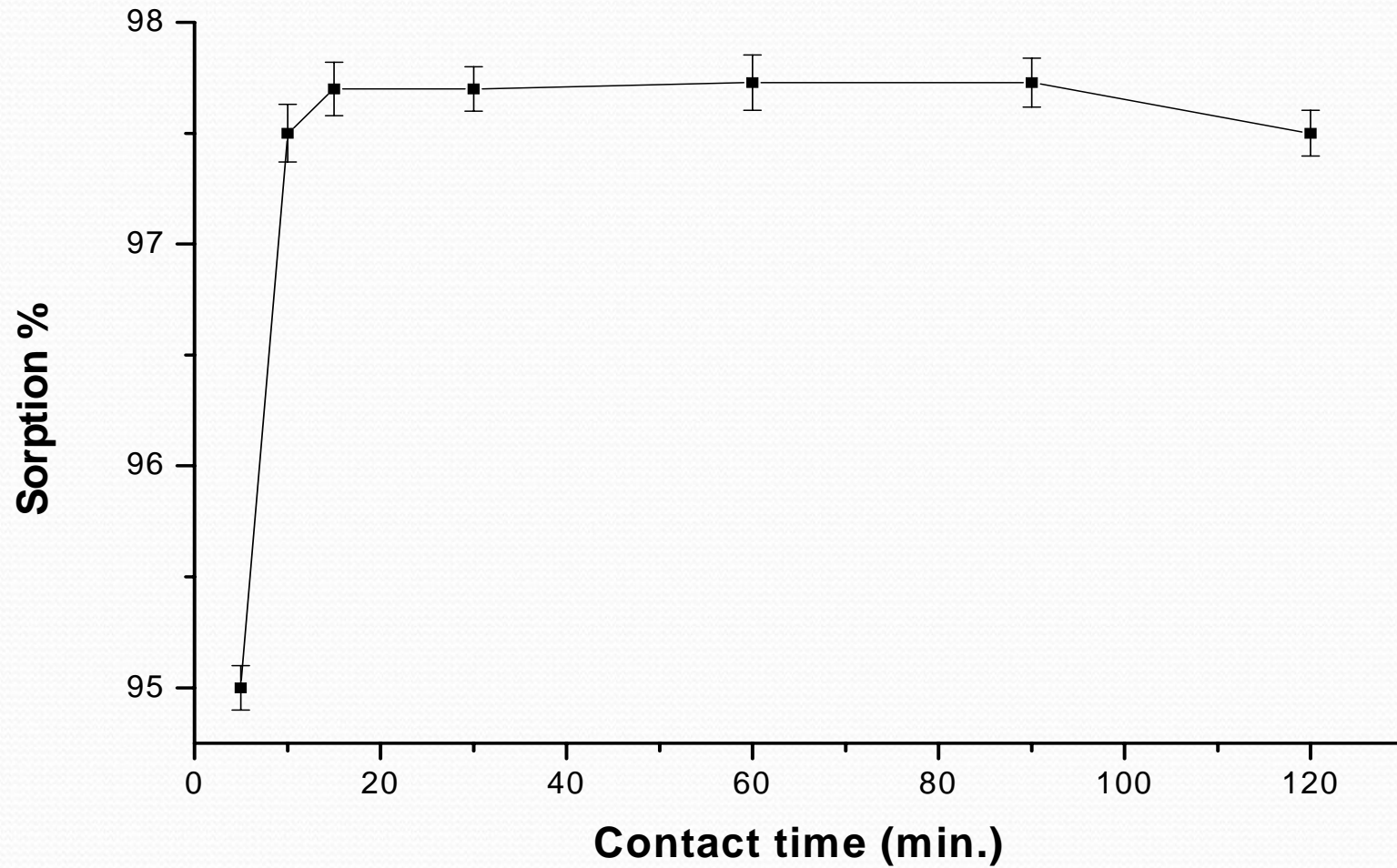
So calcium ion would not be available at this site to water hyacinth as in the other sites.



# Application

- The metals are distributed and bioaccumulated in various parts of the plant. Bioaccumulation factors are higher in roots than in leaves. Therefore, a dried root has been used in remediation of aqueous solutions.
- From our study water hyacinth bioaccumulates Uranium.

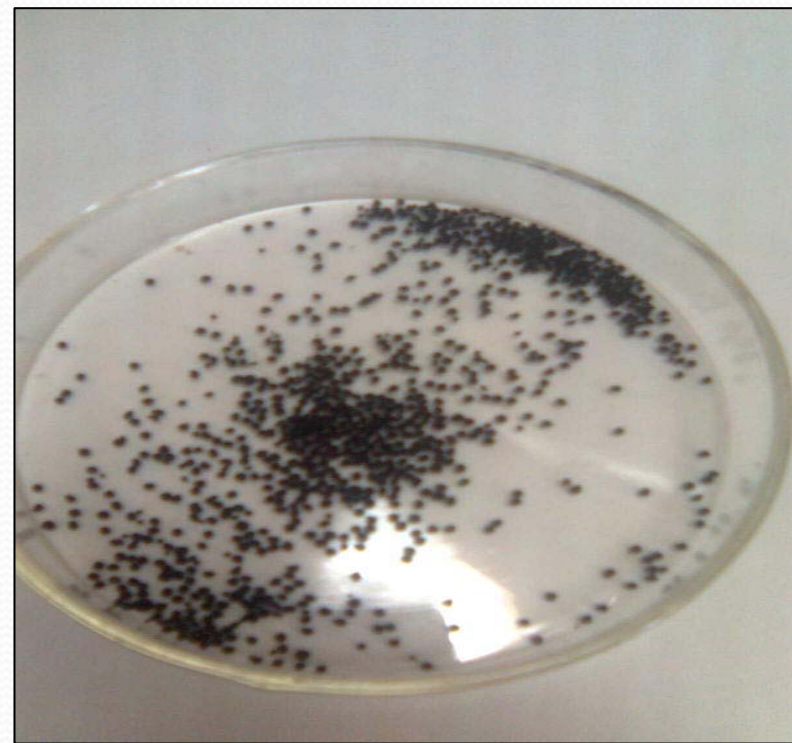
# 1- Sorption of uranium as a function of time by water hyacinth dried roots





## 2- Current work

- Sorption of La, Th, and Mix.
- Sorption of real wastes (produced water from petroleum industry).
- Immobilization.







Thank you